

## **The Determinants of Rural Women’s Decision-Making On Adopting Improved Cook-stoves to Diversify Livelihood Strategies in Busega District, Tanzania**

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### **Abstract**

This article examines the determinants influencing the decision-making process of rural women in Busega District, Tanzania, regarding the adoption of improved cook-stoves and livelihood strategies diversification. The sustainable livelihoods approach (SLA) was adopted to explain key variables of the study. A cross-sectional research design was applied to collect data from 210 rural women through a household survey. Findings show that 71.43% of the respondents preferred to use improved cook-stoves, but only 23.33% managed to adopt them; while 28.57% showed disinterest due to past accidents of kerosine stove explosions (mindsets). Price fluctuation (seasonality) emerged as the primary determinant affecting the decision to adopt improved cook-stoves; acknowledged by 96.19% of the rural women. A t-test ( $p$ -value 0.00 at  $p$ -value 0.05) analysis revealed a significant difference in food preparation hours between women with and without improved cook-stoves, indicating their positive impact. Moreover, excessive time spent on gathering firewood and cooking hindered 76.67% of rural women from effective participation in livelihood strategies diversification. In conclusion, mindsets and seasonality were the key determinants influencing rural women’s decisions on adopting improved cook-stoves. The article recommends for community development officers to empower rural women and address these determinants to facilitate informed decision-making on the adoption of improved cook-stoves to save time for livelihood strategies diversification.

**Keywords:** *adoption, decision-making, improved cook-stoves and livelihood strategies*

### **1. Introduction**

The improvement of rural women’s livelihood encompasses a wide range of interventions, targets, and adjustments necessary for active participation in livelihood strategies. In the pursuit of economic empowerment for rural women, it is crucial to recognize the significance of improving the equipment they utilize in cooking, enabling them to save time for livelihood strategies diversification. According to Guta et al. (2022), there is a relationship between the adoption of improved cook-stoves by rural women and the diversification of household livelihood strategies. Improved cook-stoves have emerged as a viable and sustainable solution to address the health, environmental, and economic challenges associated with traditional cooking practices. The adoption of improved cook-stoves exhibits a distinct disparity between developed and developing countries, wherein developed nations have embraced their usage extensively; while their widespread adoption among

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households in developing countries remains limited (Yadav & Lal, 2018). In the UK, the adoption of improved cook-stoves in this developed country has provided numerous benefits, including energy efficiency for saving time, reduced carbon emissions, and improved indoor air quality (Perros et al., 2022). In Africa and Asia, countries are implementing energy efficiency incentives, technological advancements, environmental consciousness, government policies, and changing consumer preferences to drive the shift towards improved cook-stoves (Jürisoo et al., 2018; Batchelor et al., 2019; Gould & Urpelainen, 2020). Developed countries are experiencing the positive outcomes, while developing countries are still working on shifting from traditional cooking to the use of improved cook-stoves.

According to Bharadwaj et al. (2021), Suman (2021), and Williams et al. (2022), the adoption of improved cook-stoves has significant implications for the diversification of livelihood strategies at the individual, household, and community levels. This study employs the sustainable livelihood approach (SLA) to examine how the adoption of improved cook-stoves serves as an asset, relieving the burden of collecting firewood and cooking, thereby enabling individuals to save time for engaging in various livelihood strategies. These strategies encompass both farming activities—such as crop cultivation and livestock keeping—and non-farming activities—e.g., shopkeeping, food vending, handicrafts, construction, transportation services, mining, and other endeavours. Additionally, other livelihood strategies may involve formal employment in government institutions, non-governmental organizations (NGOs), or the private sector. The adoption of improved cook-stoves is of utmost importance in releasing women's time, hence allowing them to actively participate in livelihood strategies that ensure their own survival and the well-being of their households. Rural women play a critical role in decision-making regarding cooking practices, which directly influence their adoption of improved cook-stoves within their households. Desirable improved cook-stoves for households encompass energy-saving sources such as electricity, gas, solar, and biogas stoves.

According to development professionals (Adhikari et al., 2021; Irani & Vemireddy, 2021; McGuire et al., 2022; Santhanam-Martin et al., 2021; Shaibur et al., 2021), there is a reported interest among some rural women in adopting improved cook-stoves as a means of simplifying their heavy workloads. The process of adopting improved cook-stoves is facilitated by the pivotal role of rural women in decision-making, underscoring their agency and influence in driving this transformative change (Yasmin & Grundmann, 2020). In Tanzania, as well as other Sub-Saharan African countries, the decision-making of rural women regarding the adoption of improved cook-stoves is a significant concern, as they encounter challenges in making informed choices (Ojong, 2021; Murshed, 2022). Limited decision-making power within households is a common issues faced by rural women.

Rural women have limited control over household resources, face restricted access to finance, and are often confronted by cultural or social norms that undermine their decision-making authority. These factors contribute to the lack of empowerment that

hinders their ability to make independent choices, including decisions related to the adoption of improved cook-stoves. However, despite the recognized importance of rural women's involvement in the adoption of improved cook-stoves and its potential to save time and increase participation in livelihood strategies, there has been limited research specifically examining rural women's role in decision-making processes within this context. The problem arises in areas such as Busega District and other locations in Tanzania, where women's decision-making regarding the adoption of improved cook-stoves remains limited within households (Mwingira et al., 2021).

This article aims to address two main research inquiries: (i) What are the key determinants that govern rural women's decision-making processes when adopting improved cook-stoves within their households? (ii) How does the failure to adopt improved cook-stoves impact rural women's ability to diversify their livelihood strategies? To investigate these research questions, the article examines individual mindsets, trends, and seasonality that influence the decision-making process of rural women when considering the adoption of improved cook-stoves. Specifically, the study focuses on evaluating the decision-making process of rural women in adopting improved cook-stoves for the purpose of saving time and facilitating the diversification of their livelihood strategies in Busega District, Tanzania. By shedding light on the factors that shape women's decision-making process regarding the adoption of improved cook-stoves, this study seeks to contribute to a better understanding of opportunities and challenges faced by rural women in adopting cook-stoves, and subsequently enhancing their ability to pursue diversified livelihood strategies.

## **2. Theoretical and Literature Review**

The sustainable livelihoods framework is adopted in this study to examine the complexities of livelihood strategies and decision-making processes. The concept of sustainable livelihoods was introduced in 1992 by the Brundtland Commission to address the integration of environmental and climate change concerns alongside livelihood enhancement (Kotturi, 2022). Robert Chambers further developed the concept of sustainable livelihoods in 1990 by focusing on interventions to alleviate poverty (Lamichhane, 2021). In 1997, the British Department for International Development (DFID) incorporated this approach into socio-economic development strategies; recognizing its value in addressing institutional and technological structures and processes that foster long-term opportunities for impoverished communities (Mariyono et al., 2021; Gumel, 2022). Through applying the SLA, this study conceptualizes the decision-making process of adopting technologies aimed at improving the living standards of individuals, households, and communities. It considers how different assets, external factors, and institutional arrangements influence rural women's choices and actions regarding the adoption of improved cook-stoves and the diversification of their livelihood strategies. The sustainable livelihoods framework serves as a valuable tool in understanding the complex dynamics and interdependencies involved in rural women's decision-making processes within the specific context of this study.

The core assumption of the SLA is that individuals and households possess a range of assets or resources that can be used to pursue sustainable livelihoods. These assets include human, social, natural, physical, and financial capital. The approach recognizes that the combination and interaction of these assets influence people's ability to secure their livelihoods and cope with shocks and vulnerabilities. The SLA assumes that livelihood strategies are diverse and dynamic, with individuals and households employing various activities and approaches to sustain their well-being. These strategies can include agriculture, non-farm enterprises, wage labour, migration, and social protection mechanisms. Also, the SLA emphasizes the importance of diversification and adaptability in livelihood strategies to enhance resilience and reduce vulnerability.

Another core assumption of the SLA is that livelihoods are influenced by the wider context in which individuals and households operate. This includes social, cultural, political, and environmental factors that shape opportunities, constraints, and risks. The approach recognizes that external forces—such as market dynamics, government policies, and technological advancements—interact with internal capabilities and assets to shape livelihood outcomes. It emphasizes the importance of empowering individuals and communities, and involving them in the design and implementation of development interventions. The approach recognizes that local knowledge, skills, and social networks are valuable resources for sustainable livelihoods. The SLA assumes that people have agency and can actively participate in decision-making processes regarding their livelihoods.

The merit of the SLA lies in its ability to interrelate the capacity to make informed choices regarding resource utilization in the environment, and the exploration of accessible assets by actors (Afifah et al., 2021). This approach combines various dynamics of livelihoods that serve as methods for sustaining households and communities. It promotes a resourceful mindset towards recognizing the significance of macro- and micro-nexuses in diverse livelihood exploration and sectors. The approach provides a framework for explaining the multiple assets that shape livelihoods, and identifies opportunities for improvement (Sunny et al., 2020). It takes into account a holistic and asset-based approach to developing sustainable livelihood strategies in households. However, some scholars have identified deficiencies in the theory, in being "... too household-focused and abstract to provide insights on general patterns and policy analysis" over time (Tambe, 2022: 1).

The SLA has been widely used as a framework for understanding and promoting sustainable livelihoods in various contexts. However, it has faced criticism and debate regarding its effectiveness and applicability. Supporters of the SLA argue that its strength lies in its holistic and multidimensional approach to livelihoods. It recognizes that livelihoods are influenced by a complex web of factors, including social, economic, environmental, and political dynamics. The SLA emphasizes the importance of understanding these interconnections and addressing them

comprehensively to improve livelihood outcomes. Its proponents also highlight the approach's focus on building and mobilizing assets, fostering resilience, and promoting sustainable development.

Critics, on the other hand, raise several concerns about the SLA. One major critique is its limited attention to power dynamics and structural inequalities. They argue that the approach tends to overlook the unequal distribution of resources, and the marginalized positions of certain groups within a society. This criticism calls for a more distinctive analysis of power relations and social structures that shape access to, and control over, resources (Quandt, 2018).

Another point of debate is the applicability of the SLA to different contexts. Critics argue that the approach's effectiveness may vary across diverse socio-cultural and geographical settings. They suggest that a more context-specific and participatory approach is needed to ensure that interventions are tailored to the unique needs and priorities of local communities.

Furthermore, some scholars question the ability of the SLA to address long-term sustainability and transformative change. They argue that the approach often focuses on short-term interventions, and fails to address deeper systemic issues that perpetuate poverty and inequality. As such, the critics call for a more transformative agenda that challenges underlying structures and promotes social justice.

Moreover, the SLA has been criticized for its lack of gender-sensitive analysis and failure to address women's decision-making processes and their unique needs, such as the adoption of assets in their households. The debate surrounding the approach highlights the need for ongoing refinement, adaptation, and critical analysis to ensure its relevance and effectiveness in diverse contexts. Despite these criticisms, however, this article adopts the SLA as the most suitable approach that allows for the interrelation of standpoints applied in decision-making processes regarding the adoption and utilization of assets, such as improved cook-stoves. By employing this approach, the article aims to provide a comprehensive understanding of the determinants governing rural women's decision-making and the potential benefits of adopting improved cook-stoves in diversifying their livelihood strategies. In the context of rural women's decision-making on adopting improved cook-stoves and diversifying livelihood strategies, the SLA provides a comprehensive lens to analyse the interplay between various determinants.

### **3. Research Methodology**

#### ***3.1 Study Area Location and Selection Justification***

The study was conducted in Busega District, which is located in the Simiyu Region at 2° 23' 28.5" (2.3913°) latitude south, and 33° 46' 11.8" (33.77°) longitude east. The district was selected because rural women in this area faced difficulties in making informed decisions about adopting improved cook-stoves, and have to

spend many hours per day collecting firewood (Rupf et al., 2015; Hailemariam & Mekonen, 2021). Additionally, the Busega District has been significantly impacted by deforestation resulting from the cutting of trees for firewood, leading to adverse consequences such as increased travel distances for rural women in search of firewood, and subsequent closure of their petty trades (GCF, 2017). Specifically, the study was carried out in six villages: Yitwimila A and Yitwimila B in Kiloleli Ward; Bulima and Bukabile in Nyashimo Ward; and Kabita and Nyamikoma in Kabita Ward. These villages were selected because they have markets and shops that sell improved cook-stoves, but most rural women have failed to adopt them.

### ***3.2 Research Design***

This study utilized a cross-sectional research design to collect data from a sample size of 210 rural women through a household survey. The survey involved administering a questionnaire to gather insights into the mindsets, trends, and seasonality as probed determinants of rural women's adoption of improved cook-stoves. The design was chosen to provide a comprehensive understanding of the population's characteristics in relation to the study topic. Specifically, the study examined rural women's decision-making process as an independent variable, the adoption of improved cook-stoves as a dependent variable, and the role of diversification of livelihood strategies as a mediating variable.

### ***3.3 Sampling Frame, Sample Size and Procedures***

The sampling frame for this study comprised a list of households in the study area, specifically those with at least one rural woman. This list of households was obtained from the village executive officer, who maintained records containing the names and locations of residents. Rural women were the target population of interest for this study due to the challenges they faced in making decisions about adopting improved cook-stoves, and the potential impact this decision can have on their livelihoods. To select a representative sample, simple random sampling was applied, resulting in the inclusion of 210 rural women from various households. The sampling process involved identifying rural women responsible for daily household chores. This technique was applied to minimize bias and ensure that the sample's representativeness was achieved.

Additionally, purposive sampling was used to select participants for the focus group discussions (FGDs) and key informants. Six (6) FGDs were conducted, each consisting of ten (10) participants chosen based on their ability to articulate their thoughts. These participants were identified during the household survey. In addition, thirteen (13) key informants were purposively selected. Key informants included the district commissioner, community development officer, agricultural extension officer, social worker, three (3) ward executive officers, and (6) six village executive officers. Selecting key informants in the study helped to incorporate the perspectives and expertise of individuals who were closely involved with rural women, and had valuable knowledge about the study area.

### ***3.4 Data Collection Methods and Instruments***

In this study, a combination of qualitative and quantitative data was collected from various sources. The household survey was applied to collect both qualitative and quantitative data. The survey involved visiting households and conducting interviews with rural women, and utilizing a questionnaire with a mix of open-ended and closed-ended questions to efficiently and systematically collect data from a predetermined number of respondents. To gain deeper insights, six (6) FGDs were conducted, one in each village, with ten (10) participants per group; which provided a qualitative exploration of the determinants of rural women's decision-making. Guides and checklists were used to facilitate these discussions. Non-participant observations were also carried out to observe rural women in their everyday settings, using an observation checklist to document cooking methods, locations, firewood sources, and cooking facilities in households. Key informant interviews were conducted using semi-structured question checklists to gather perspectives from service providers regarding rural women's decision-making processes when adopting improved cook-stoves in their households.

Additionally, secondary data was collected from journal articles, books, and district council reports regarding the utilization of improved cook-stoves; including electricity, gas, and solar options. Information on electric supply charges, tariffs, and recharge systems was obtained from the profiles of the Tanzania Electric Supply Company (TANESCO). Secondary data sources were consulted to generate insights and obtain records from existing documentation.

### ***3.5 Data Processes and Analysis***

The data collected in this study were managed and analysed using both qualitative and quantitative research techniques. Qualitative data gathered through interviews, FGDs, and observations were analysed using content analysis to identify patterns, themes, and meaningful concepts. The stages of content analysis started by defining the research objective, selecting participants for data collection, developing coding categories, and applying coded categories to write an in-depth report. The contents were then organized, modified, and synthesized to derive meaningful insights.

Quantitative data were analysed using the International Business Machines (IBM) Statistical Package for Social Sciences (SPSS), version 20. Cross-tabulation was employed to calculate the respondents' age, examine different mindset responses (attitudes, preferences, and previous experiences), analyse trends (applicability and availability), and consider seasonality factors (price fluctuations and employment opportunities). A five-point Likert-scale was utilized to measure the level of agreement with statements about attitudes towards adopting improved cook-stoves in households. The Likert-scale included response options ranging from 'Strongly Agree' to 'Strongly Disagree.' The internal consistency of the Likert-scale was assessed for reliability using Cronbach's alpha, resulting in a value of 0.742, indicating compatibility with the variables as it exceeded the threshold of 0.6.

Ordinal data from the Likert-scale were analysed using one-way ANOVA to examine any significant differences among the response groups. Furthermore, a one-sample t-test was conducted to analyse the significant difference in the number of hours spent on food preparation and cooking between rural women who owned improved cook-stoves and those who did not. The purpose was to compare the time spent on these activities between rural women who used traditional methods, and those who utilized improved cook-stoves as modern technologies.

The one sample t-test formula is:

$$t = \frac{(\bar{x} - \mu)}{\left(\frac{s}{\sqrt{n}}\right)}$$

Where:  $\bar{x}$  is the sample mean;  $\mu$  is the population mean;  $s$  is the sample standard deviation; and  $n$  is the sample size.

**Table 1: Reliability Test of the Likert-Scale**

<b>Reliability Statistics</b>	
<i>Cronbach's Alpha</i>	<i>Number of Items</i>
0.742	5

#### **4. Findings**

##### **4.1 Age Distribution among Rural Women**

The results presented in Table 2 show that the age distribution of rural women in Busega District was as follows: 15.71% were between 15 and 24 years old, 34.76% were between 25 and 34 years old, 24.29% were between 35 and 44 years old, and 25.24% were 45 years old and above. This suggests that the majority of rural women responsible for managing household chores were aged between 25 and 34 years. These rural women were found in their households during working hours, and they testified that they were responsible for fetching firewood and cooking meals for household consumption. Due to deforestation in the area, most rural women had to travel for almost two hours every day to fetch firewood. Furthermore, observations indicated that these rural women assumed a greater responsibility for preparing meals for household consumption. However, they faced significant challenges in assessing the feasibility of adopting improved cook-stoves.

**Table 2: Respondent's Age Categories**

<b>Age categories</b>	<b>Frequency (n=210)</b>	<b>Percentage</b>
15-24 Years	33	15.71
25-34 Years	73	34.76
35-44 Years	51	24.29
Above 45 Years	53	25.24
<b>Total</b>	<b>210</b>	<b>100</b>



**4.2 Decision-Making on Adopting Improved Cook-Stoves**

Respondents highlighted several factors that influence their decision-making process regarding the adoption of improved cook-stoves within their households. This study comprehensively analysed individual mindsets, encompassing attitudes, preferences, and past experiences. Additionally, it examined overarching trends like applicability and availability, as well as seasonality factors such as price fluctuations and employment opportunities. These variables collectively shaped the decision-making process concerning the adoption or rejection of improved cook-stoves. Notably, the study area exhibited a likelihood of adopting various improved cook-stoves, including electric, gas, solar, and biogas energy fuels.

**4.2.1 Attitudes on Adopting Improved Cook-Stoves**

The study examined attitudes on adopting improved cook-stoves within households. It determined the respondents' attitudes towards the adoption of the devices by administering the Likert-scale statement that states: "I have a keen interest in acquiring an improved cook-stove as it is essential for cooking purposes within our household." To evaluate these attitudes, a five-point Likert scale was employed, prompting respondents to indicate their level of agreement, ranging from 1 for 'Strongly Interested', 2 for 'Interested', 3 for 'Neutral', 4 for 'Not Interested', and 5 for 'Strongly not Interested'.

To assess the variation in interest levels across different responses, a one-way ANOVA was conducted. The findings revealed an overall mean agreement score of 2.0, with a standard deviation of 1.4. The calculated F-statistic was 6.9, yielding a *p*-value of 0.03 (Table 3). Based on these results, the study concludes that a significant difference exists in the level of interest among the various response categories at a significance level of *p* < 0.05. This indicates that the interest with the statement "I have a keen interest in acquiring an improved cook-stove as it is essential for cooking purposes within our household" significantly varies across the different response categories.

**Table 3: One-way ANOVA Results from Five-Point Likert-Scale**

Source	Sum of Squares (SS)	Degrees of Freedom (df)	Mean Squares (MS)	F-Statistics	P-Value
Between Groups	30.0	4	7.5	6.9	0.03
Within Groups	35.0	95	0.4	N/A	N/A
<b>Total</b>	<b>65.0</b>	<b>99</b>	<b>N/A</b>	<b>N/A</b>	<b>N/A</b>

Those individuals who expressed disinterest and strong disinterest elaborated their desire for food cooked by using traditional methods, citing dissatisfaction with the taste of food prepared with improved cooking stoves. In FGDs, they described such food as lacking flavour; and indicated a preference for the appetizing aroma associated with food cooked over firewood or charcoal. The Village Executive Officer (VEO) provided the situation of prevailing cooking practices within rural households as he detailed:

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## Determinants of Rural Women's Decision-Making on Improved Cook-Stoves

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*The primary hindrance to the widespread adoption of improved cook-stoves primarily stems from the attitudes of certain rural women who exhibit resistance towards their usage. Furthermore, their lack of interest in the taste of food prepared by using such improved cook-stoves further contributes to this limitation. The acceptance of these devices, rather than the willingness to utilize them, poses a significant barrier for some rural women, as their attitudes towards the taste of food play a crucial role (Interview with the VEO, August, 2017).*

The attitudes of some of the respondents towards the taste of food cooked using improved cook-stoves have significantly contributed to guiding their decision-making processes. The finding here is that some rural women do not like or enjoy the taste of food cooked by using electric and gas cookers.

The study discovered that the distinctive information on the women's attitudes towards adopting improved cook-stoves that has contributed to low uptake in the study area. Their negative attitudes towards the taste of food cooked with improved cook-stoves stemmed from the kind of food from traders who were advertising the devices. The major food used for demonstration was rice. Hence, more demonstrations, and on more foods, are needed to create awareness of the usefulness of these devices also in saving time, rather than focusing only on food items cooked by using these devices.

*4.2.2 Preferences and Past Experiences on Improved Cook-Stoves towards Decision-Making*  
Rural women's decision-making regarding the adoption of improved cook-stoves was subjective to their preferences and past experiences. Here, the assessment involved asking respondents about their individual preference to adopt any of the improved cook-stoves in their households. The responses were then categorized by using a two-point index scale, where a preference was indicated by 1, and a lack of preference was indicated by 2. The results of the scale revealed that 71.43% of the respondents preferred to adopt improved cook-stoves in their households, while 28.57% expressed neglect in using such devices for various reasons (Table 4).

**Table 4: Rural Women's Preferences on Adopting Improved Cook-Stoves (n=210)**

Preference	Frequency	Percentage
Prefer	150	71.43
Do not prefer	60	28.57
<b>Total</b>	<b>210</b>	<b>100</b>

For example, some rural women who were adamant in adopting gas cookers cited the inconvenience of frequently changing gas cylinders. One interviewee stated:

*I dislike using a gas cooker in my household due to the inconvenience of having to change the cylinder periodically. Additionally, I have concerns about the safety hazards associated with gas cookers, as they can sometimes explode and cause accidents. For instance, back in the early 1980s, missionaries introduced kerosene stoves to our community, and many people embraced them to simplify cooking. Unfortunately, in several households, these cookers exploded and resulted in the loss of household members' lives. Therefore, I am hesitant to use either an electric or gas cooker in my house (Interview with respondent, August, 2018).*

Rural women who had previously encountered accidents resulting from improper operation of stoves exhibited a sceptical viewpoint towards adopting improved cook-stoves. Their past negative experiences made them more adamant in using cook-stoves. This shows that they lacked awareness on the distinctions between previous stove models and the contemporary ones. Also, they had insufficient knowledge regarding the causes of explosions associated with the improved cook-stoves.

#### **4.3 Decision-Making Led by Trends of Improved Cook-Stoves**

Furthermore, the article examined trends to assess the impact of rural women's decision-making process on the adoption of improved cook-stoves in households. Specifically, the analysis focused on various factors related to stove adoption, including the cooking methods and locations employed within households, as well as the availability and accessibility of improved cook-stoves in the surrounding areas.

##### **4.3.1 Decision on Applicability of Improved Cook-Stoves in Households**

Improved cook-stoves, designed to streamline household cooking tasks, demonstrate compatibility with local cooking practices and environments. Nevertheless, rural women exhibited varying perspectives on the suitability of these stoves for their households, influenced by their immediate surroundings. To evaluate their opinions, a two-point index scale was employed, with a rating of 1 indicating applicability, and 2 indicating inapplicability; thereby facilitating an analysis of their responses.

Approximately 58.6% of the respondents perceived improved cook-stoves as suitable for their respective environments, whereas 41.4% deemed them unsuitable (Table 5). These responses indicate that the applicability of improved cook-stoves varied based on the specific surroundings of each household.

**Table 5: Responses on Applicability of Improved Cooking Stoves in Households**

<b>Aspect</b>	<b>Frequency (n=210)</b>	<b>Percentage</b>
Applicable	123	58.6%
Not applicable	87	41.4%
<b>Total</b>	<b>210</b>	<b>100.0%</b>

Observations revealed that the designs and surroundings of many rural dwellings discouraged rural women from opting for improved cook-stoves. A majority of rural households prepared meals in outdoor kitchens, such as beneath trees or in small structures thatched with grasses. Consequently, the use of improved cook-stoves faced obstacles in such settings. During FGDs, participants explained that the adoption of improved cook-stoves must commence with addressing the cooking spaces utilized in households. The perspectives of rural women regarding the usage of improved cook-stoves exhibited considerable variations influenced by their household surroundings. As such, most rural women who lived in poor houses, thatched with grasses, rejected to adopt improved cook-stoves at all; hesitating about the issue of explosions. Observations also showed that, it is not possible to use improved cook-stoves outside under trees or in poor kitchens.

*4.3.2 Decision-Making on Availability of Improved Cook-Stoves in Busega District*

The study discovered that the availability of improved cook-stoves in local shops and markets plays a crucial role in guiding rural women's decision-making processes regarding their adoption. The article primarily focused on various types of improved cook-stoves—including electric, gas, solar, and biogas cookers—which were anticipated to be available within the study area. The study investigated the availability of these improved cook-stoves in local shops and markets, and its influence on the decision-making processes of rural women to adopt them. The findings, as presented in Table 6, indicate that 12.86% of the respondents considered electric cookers to be available, while 87.14% deemed them unavailable. Gas stoves were deemed available by 94.29% of the respondents, with only 5.71% considering them unavailable. Conversely, solar and biogas cookers were perceived as being unavailable by 100% of the respondents.

**Table 6: Responses about Availability of Improved Cook-Stoves**

Device	Electric cooker		Gas cooker		Solar cooker		Biogas cooker	
	Freq.	Percentage	Freq.	Percentage	Freq.	Percentage	Freq.	Percentage
Available	27	12.86	198	94.29	00	00	00	00
Not available	183	87.14	12	5.71	210	100	210	100
<b>Total</b>	<b>210</b>	<b>100</b>	<b>210</b>	<b>100</b>	<b>210</b>	<b>100</b>	<b>210</b>	<b>100</b>

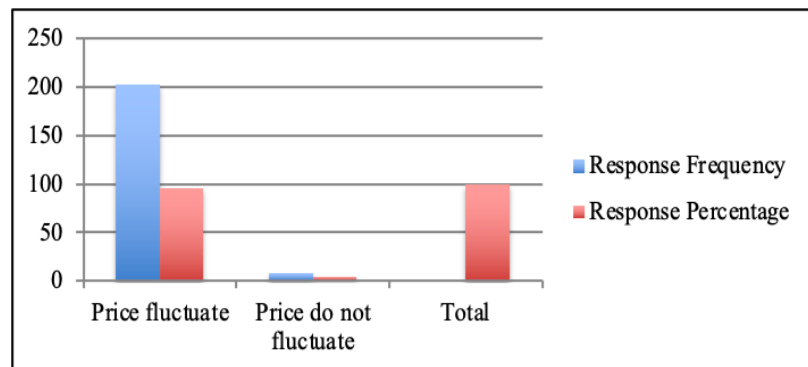
Based on the results, gas stoves exhibited the highest availability and sales range compared to other types of cookers. Observations revealed that gas stoves, along with their cylinders, were readily available in local shops and markets, and they were commonly utilized by the majority of rural residents who decided to adopt these labour-saving mechanisms. In contrast, electric stoves appeared to be perceived as more expensive, resulting in fewer households owning them, as indicated by the frequency data. In cases where electric stoves were desired, they were typically sourced through special orders. Consequently, most rural women regarded electric stoves as unavailable within their surroundings. Similarly, other improved cook-stoves such as solar and biogas cookers were absent from both households and local shops and markets. Gas cookers were available in the local environment, although some individuals lacked awareness of their existence. As a result, some rural women faced challenges in making decisions to adopt these cookers due to the lack of information regarding their availability in their surroundings. Shopkeepers and traders, as service providers, play a crucial role in promoting gas stoves by advertising their benefits in various locations; and educating the public about their advantages.

*4.4 Decision-Making Based on Seasonality on Adopting Improved Cook-Stoves*

This paper examined the influence of seasonality on rural women's decision-making processes regarding the adoption of improved cook-stoves. In this study, seasonality refers to the recurring changes characterized by price fluctuations and variations in employment opportunities.

*4.4.1 Price Fluctuation of Improved Cook-Stoves and Decisions Made*

In shops and markets, the fluctuating prices of improved cook-stoves significantly impact the decision-making process of rural women when considering their purchase. These price variations throughout different seasons pose a major obstacle to adoption, as it becomes challenging to predict the affordability of these devices at any given time. To assess this aspect, rural women were asked to confirm whether they had experienced price fluctuations in various seasons. Their responses were evaluated by using a two-point scale index, with a rating of 1 indicating the presence of price fluctuations; and 2 indicating their absence. The findings indicated that, in Busega District, 96.19% of rural women confirmed encountering price fluctuations in shops and markets, particularly in relation to the exchange of gas cylinders (Figure 1).



**Figure 1: Fluctuation of Improved Cook-Stoves' Prices**

One respondent from Bulima Village shared her experience, stating:

*I use a gas cooker, but there are times when I cannot afford the prices for exchanging the cylinder when it becomes empty. The prices keep changing constantly, and our local suppliers do not consistently provide the service. When services are unavailable in our village shops, I have to travel 20 kilometres to Magu Town using local buses. At times, I have to resort to using charcoal and firewood, which is time-consuming. This affects my ability to open my shop on time, and it significantly impacts my business. My daily income decreases due to the additional household chores, especially cooking, which consumes a significant portion of my time (August, 2017).*

The fluctuating prices of the devices posed limitations on women's ability to purchase them, as they struggled to estimate expenses in different seasons. Of particular concern were the price fluctuations of gas cylinders, which required refilling at specific intervals. During FGDs, rural women shared how these price fluctuations hindered their decision to adopt improved cook-stoves. They expressed concerns about the sustainability of investing in devices with unpredictable prices, suggesting that it was more feasible to continue using traditional facilities that were familiar, inexpensive, and readily available.

#### *4.4.2 Employment Opportunities for Rural Women*

Employment opportunities, as a significant source of income, played a crucial role in guiding rural women's decisions regarding the adoption of improved cook-stoves. The participants were asked whether they were employed by either the government or NGOs, and their responses were evaluated using a two-point index scale. A rating of 1 denoted 'Employed'; while 2 represented 'Not Employed'. The results in Table 6 indicated that 26.67% of the rural women participants were employed, while the majority (73.33%) were not employed. These findings suggest that the prospects of employment were limited for rural women, primarily due to their lack of specialized skills in various fields. In the study area, the government or NGOs only employed a small number of women who possessed certificates, diplomas or degrees. Consequently, the majority of rural women remained unemployed and faced the challenges of inconsistent incomes. Research has also highlighted the gender disparity in employment opportunities, indicating that women generally have fewer chances for employment compared to men. Unemployed rural women encountered difficulties in estimating their monthly income as they relied on small-scale trading, which often resulted in low earnings.

**Table 6: Employment Opportunities**

<b>Aspect /employment opportunities</b>	<b>Frequency</b>	<b>Percentage</b>
Employed	56	26.67
Not employed	154	73.33
<b>Total</b>	<b>210</b>	<b>100</b>

#### *4.5 Hours Used for Preparations and Cooking versus Livelihood Strategies*

The process of gathering fuel for cooking is an integral part of meal preparation. The findings presented in Table 7 provide insights into the time rural women spend on fuel gathering and cooking. It was observed that 44.29% of rural women spent 0–3 hours, 3.81% spent 4–6 hours, and 59.52% spent 7 hours or more on these activities. Similarly, in terms of diversifying their livelihood strategies, 57.14% spent 0–3 hours, 19.53% spent 4–6 hours, and 23.33% spent 7 hours or more. These results indicate that those who dedicated at least 0–3 hours to fuel preparation and cooking were also able to allocate at least 7 hours to participate in livelihood strategies. It was noted during FGDs that rural women who spent minimal time (0–3 hours) on fuel preparation and cooking were able to do so because they had adopted improved cook-stoves, which helped reduce their workload. However, the findings also revealed that only a few women were able to actively participate in livelihood strategies. According to the discussions, these women earned low incomes from agricultural activities such as crop production and livestock keeping; as well as from non-farm activities such as shopkeeping, food vending, and handcrafting. The lack of employment opportunities for rural women significantly influenced their decision-making process when it comes to adopting improved cook-stoves in their households. It is clear that encouraging rural women to adopt such stoves will not be effective unless their issue of low-income is adequately addressed.

**Table 7: Hours Used for Preparations and Cooking Versus Livelihood Strategies**

Hour Interval	Preparations and Cooking Food		Livelihood Strategies	
	Frequency	Percentage	Frequency	Percentage
0–3	93	44.29	120	57.14
4–6	8	3.81	41	19.53
7 and above	125	59.52	49	23.33
<b>Total</b>	<b>210</b>	<b>100</b>	<b>210</b>	<b>100</b>

Furthermore, the results of the t-test revealed a significant difference in the *p*-value (0.00) regarding the hours spent on fuel preparation and cooking between the two groups of rural women: those who owned improved cook-stoves and those who did not, as depicted in Table 8. This finding suggests that individuals who possessed improved cook-stoves were able to allocate more time directly to the cooking process, rather than expending time on firewood gathering. It is essential for rural women to explore means of reducing the time dedicated to fuel collection, as this constitutes a form of unpaid work. Development stakeholders should prioritize educating marginalized communities about the importance of allocating adequate time to livelihood strategies, as opposed to being occupied with repetitive household tasks such as fuel gathering and cooking. By doing so, these communities can enhance their engagement in productive activities and reduce the burden of unpaid work.

**Table 8: T-Test for Respondents' Amount of Hours Used on Preparations and Cooking Food**

	T-test for equality of means					
	<i>t</i>	<i>df</i>	<i>Sig.</i> (2-tailed)	<i>Mean</i> Difference	<i>95% Confidence</i> <i>Interval of the Difference</i>	
					<i>Lower</i>	<i>Upper</i>
Equal variances assumed	83.22	210	0.00*	1.033	1.01	1.06

Note: \*Statistically Significant (p-value 0.05)

## 5. Discussion

This study examined the determinants that govern the decision-making process of rural women when adopting improved cook-stoves, and explored their ability to diversify livelihood strategies. The study findings revealed several key determinants influencing this decision-making process. These determinants encompass mindset responses, such as attitudes, preferences, and past experiences. Furthermore, trends—including applicability and availability—played a significant role in shaping decision outcomes. Additionally, seasonality factors, such as price fluctuations and employment opportunities, were found to be influential in this context.

The study's results also shed light on a noteworthy demographic pattern among the interviewed rural women. It was observed that a majority of these rural women, falling within the age range of 25 to 34 years, emerged as a significant segment in the study's sample. This demographic insight provides a valuable depth to the understanding of

the decision-making dynamics within the rural population. Different age groups of rural women enabled to discover the distinct priorities, values, and perspectives, which significantly impacted their decision-making processes. They highlighted the importance of considering age as a relevant factor for rural women decision-making that shaped attitudes towards adopting improved cook-stoves.

The attitudes of the respondents towards the statement “I have a keen interest in acquiring an improved cook-stove as it is essential for cooking purposes within our household” were assessed by using a five-point Likert-scale. The findings indicate that there is a significant difference in the attitudes of the participants towards adopting improved cook-stoves in their households. Similarly, these results relate to the report stating that rural women differs in attitudes towards making decisions about adopting improved cook-stoves over traditional methods to increase cooking speed (Petrokofsky et al., 2021). For instance, in this study, a notable variation in the attitudes towards the taste of food cooked by using improved cook-stoves was observed among the respondents. Some respondents expressed positive attitudes, while others held negative attitudes in this regard, which influenced their decision-making processes regarding whether to adopt improved cook-stoves or not.

The majority of the respondents, comprising 71.43%, exhibited a positive inclination towards adopting improved cook-stoves. These individuals recognized the potential benefits offered by these stoves, such as improved cooking efficiency, reduced fuel consumption, and enhanced safety features. Their preference for adopting these stoves suggests a willingness to embrace technological advancements and improve their cooking experiences. This finding aligns with the research of Moses and MacCarty (2019), which elucidated that while improved cook-stoves are designed to be adaptable in diverse scenarios, users choose to conduct trials to assess their compatibility within the contexts of individual households.

The research findings of this study have uncovered significant insights regarding outdoor cooking practices in rural areas, which frequently act as one of the barriers to the adoption of improved cook-stoves. These findings are consistent with a study by Gill-Wiehl et al. (2021), which concluded that initiatives aimed at promoting improved cook-stoves often face challenges in meeting the preferences of cooks. According to this study, the decision-making process in typical rural areas is influenced by factors such as past experiences on the explosions of the devices, stove design, fuel accessibility, or management challenges. Jagoe et al. (2020) found a similar situation in Kenya, where the time burden was “... increasing in many areas as a result of deforestation, forcing women” to shift to improved cook-stoves, but were facing several obstacles to do so. The information revealed by this study is particularly noteworthy as it sheds light on specific obstacles that hinder the decision of rural women to adopt improved cook-stoves. It also highlights the dominance of gas cook-stoves as a more popular and accessible cooking option among the surveyed population. However, the unavailability of solar and biogas cookers suggests a lack



of access to, or awareness of, these alternative cooking technologies. Addressing the barriers related to their past experiences on the explosions of the devices and outdoor cooking practices; supported by increasing awareness and accessibility of alternative cook-stove options: all such efforts can be made to overcome the challenges identified in this study, and foster the adoption of improved cook-stoves in rural areas.

The findings emphasize the significance of considering the employment status of rural women when examining their decision-making processes related to the purchase of improved cook-stoves. The employment situation shed light on various factors, such as income levels and financial constraints, that influence their ability to afford and adopt these stoves. Furthermore, even when women do secure employment, they often experienced reduced efficiency due to the additional responsibilities they bore in serving household members (Neuschmidt et al., 2022). Their income level was linked to the problem of price fluctuations that significantly impacted rural women's decision-making process on the adoption of improved cook-stoves. The results show that 96.19% of rural women's decision-making on adopting improved cooking stoves was highly affected by price fluctuations in shops and markets. Similar findings have been documented in Nigeria: that stove stacking, pricing system, and risky practices on cook-stove transitions contribute to the decision-making of users for adopting them in their households (Jewitt et al., 2020). When the prices of improved cook-stoves experienced frequent and unpredictable price changes, this created uncertainty and financial challenges for potential users; which in turn deterred individuals, especially those with limited financial resources, from adopting these cook-stoves.

Also, the study findings indicate that the primary obstacle hindering the adoption of improved cook-stoves among rural women is the unreliability of their income, primarily derived from petty trading. As a result, they resort to using firewood for cooking, which is a time-consuming method that limits their ability to actively engage in livelihood strategies for their own well-being. In addition, the research findings indicate that individuals who had access to improved cook-stoves were able to save time that would have otherwise been spent on fuel gathering. The majority of rural women (76.67%) opted to use traditional methods that entailed fuelwood gathering and cooking, while a minority (23.33%) managed to participate effectively in livelihood strategies for at least 7 hours and above. This finding emphasizes the significance of reducing the time dedicated to fuel collection, particularly for rural women who often bear the burden of this unpaid work. By adopting improved cook-stoves, individuals can allocate more time directly to the cooking process, which has several implications. First, it allows for more efficient and streamlined cooking practices, potentially leading to improved productivity and better utilization of available resources. This can be particularly beneficial for rural women who are engaged in multiple responsibilities and tasks within their households and communities. Reducing the time spent on unpaid household tasks to rural women can enable them to actively pursue income-generating activities and improve livelihoods within their households.

## **6. Conclusion**

It is evident from the findings of the study that factors determining rural women's decision-making on the adoption of improved cooking stoves include individual mindsets such as attitudes, preferences, and previous experiences; as well as trends such as the methods and places where the devices are applicable and available, including seasonality such as employment opportunities and price fluctuations. The study revealed that some barriers were associated with mindsets, such as negative attitudes, preferences, and past experiences. Some rural women were sceptical about the trends, such as the applicability in their household surroundings and the availability of improved cooking stoves in their local markets and shops. Seasonality, such as price fluctuations and the lack of employment opportunities, hampered the majority of rural women in deciding to adopt improved cook-stoves as they lacked sufficient incomes to purchase the devices.

## **7. Recommendations**

Intervention packages from community development planners should focus on capacity building for rural women to transform their adverse mindsets and encourage them to adopt improved cook-stoves. Also, multi-sectoral approaches aimed at improving livelihoods in rural communities should place greater emphasis on energy supplies and facilities to encourage rural women to adopt improved cook-stoves in their households.

On its part, the government, through energy and device wholesalers, should expand its efforts to provide services in rural areas by improving infrastructure so that local suppliers can manage to supply improved cook-stoves at affordable prices and offer sustainable allotments. It should also prioritize gender transformative approaches and policy engagement by integrating improved energy principles into development interventions. Embracing gender transformative approaches and engaging rural women in policy processes will not only empower them, but also drive social progress, economic growth, and inclusive development for all people.

## **Acknowledgments**

I acknowledge the financial support provided by the University of Dodoma during the writing process of this paper.

## **Declaration of Interest Statement**

I, Deborah Ngusa declare that I have no conflicts of interest in the work presented in this manuscript.

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